

Iowa Wind Energy Checklist

A Step-By-Step Guide
for Cities, Schools, Municipal Utilities,
Rural Electric Cooperatives, Businesses
and Landowners

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Iowa Wind Energy Checklist

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Introduction



Wind energy has come of age in the 21st century. According to the American Wind Energy Association, by 2003 the world's wind energy generating capacity was about 30,000 Megawatts (MW), with the United States second only to Germany in installed capacity. Iowa is host to 423 MW of installed wind turbines, with enough generation to meet the electricity needs of more than 130,000 homes.



Wind developments in Iowa include utility-scale wind farms, individual turbines at schools and businesses, and small-scale generators on farms and for homes.

Is your organization ready to become a wind facility owner? The Wind Energy Checklist will help you determine whether wind energy will work for you and how to develop a wind turbine project.

How to Use The Wind Energy Checklist

The Wind Energy Checklist provides guidance to cities, schools, municipal utilities, rural electric cooperatives, businesses and landowners contemplating small-scale wind energy development. The checklist is not intended for large-scale developers, but for those who want to construct one turbine or a small number of turbines at one location.

Numerous organizations offer information about various aspects of wind energy development. The Wind Energy Checklist brings many of those resources together to show potential wind developers the technical, financial and contractual steps involved when installing a turbine.

Throughout this publication, references are made to materials and Web sites that can provide greater detail. The checklist also includes an extensive list of resources and references, along with worksheets that can be used to track your own electrical and budget information.

The DNR does not guarantee that all projects follow these exact steps. Every project is unique, and therefore may face unique issues.

Energy Data



Step 1: Gather Facility or Utility Energy Use Data and Information

Before project leaders can make decisions about the feasibility of a wind project, they must have a clear picture of their current energy use. For either a facility or a utility, this should include the analysis of utility bills for at least one year, and preferably over multiple years. Data needed will be:

- Average daily consumption in kilowatt hours (kWh)
- Highest and lowest consumption in kWh
- Monthly and yearly consumption in kWh
- Average daily peaks in kilowatts (kW)
- Highest and lowest kW load, coincident with utility peak

Utility data will cover the past and present, but the future is also an important consideration. What changes in energy consumption might be expected in future years? Will new processes or spaces be added in a facility, or might something cause consumption to decrease? Is the overall community growing or declining?

Projecting future electric needs will help determine whether additional generation from a wind project will be needed and whether its costs can be recovered.



Step 2: Measure Impacts of Energy Efficiency

A facility or utility should seek to minimize its energy consumption through energy efficiency before installing new generation such as a wind project. Investments in energy efficiency improvements are often more cost-effective than adding new power generation, whether a wind turbine or another type of unit.

Efforts to increase electrical efficiency typically focus on the following areas:

- Residential facilities: sizing and efficiency of air conditioning equipment, appliance efficiency

- Commercial facilities: lighting efficiency, air conditioning sizing and efficiency, appliances and other equipment
- Industrial facilities: motors and drives, process efficiency, lighting, heating and cooling and other equipment

Efficiency improvements should be made before beginning the sizing process for a wind project. Potentially reducing the need for electricity through efficiency measures can affect the size and design of a wind project, as well as its overall economic feasibility.

Wind Assessment



Step 3: Perform a Preliminary Wind Assessment

A fairly inexpensive preliminary wind assessment can often show if a wind project is worth pursuing. The preliminary assessment can determine the approximate price of energy from a wind turbine or turbines and the anticipated payback for the investment. A facility owner may be able to conduct some of the work in the preliminary study on his or her own.

For a preliminary assessment, wind resource monitoring at the specific site is not required. Data from neighboring areas can be used, such as from National Weather Service airport data. The Iowa Energy Center's Web site at www.energy.iastate.edu includes wind speed maps of the general wind regimes across Iowa. It also includes a Wind Speed and Turbine Output Calculator, providing estimated wind speed data for 2,000 sites around the state.

By using the calculator, the user can obtain a preliminary projection of the energy output for selected turbines at various heights and wind speeds. On the next page is an example of the type of data that can be obtained from the calculator, comparing the same turbine in two different locations of the state.

Comparison of Wind Turbine at Two IA Locations*

	Hancock County Site	Henry County Site
Model Mean Wind Speed (miles/hour)	16.87	14.65
Model Air Density	1.222	1.229
Mean Wind Power Density (watts/meter squared)	422	287
Capacity Factor	33.83%	25.25%
Estimated Annual Output (kilowatt hours)	2,228,430	1,652,792

* The model is the Zond Z50, on unobstructed ground at height of 164 feet

A comparison of two locations in Iowa illustrates how a relatively small increase in wind speed results in a larger increase in electrical output. The chart at the left also demonstrates the productivity of a wind project — the wind does not blow all the time, and therefore the actual power produced is often lower than the rated capacity of a turbine. The capacity factor is the actual power produced over a period of time expressed as a percentage of the rated capacity (the size of the turbine).

In a preliminary wind assessment, generalized cost figures, energy production estimates and cost savings estimates can be used to develop an initial economic analysis of a wind project.

Windustry, a non-profit organization helping farmers and others with small wind projects, has an online wind turbine evaluation spreadsheet tool at: www.windustry.com. The user can input information on the type of turbine, estimated annual average wind speed, electricity use and electric rates, and financing and income taxes. The program estimates cash flows and the rate of return on investments.



Step 4: Conduct a Wind Feasibility Study

Assuming the results of the preliminary assessment are positive, a more in-depth wind feasibility study can be conducted. The wind feasibility study will consider the following factors:

- Wind speed data
- Size, design, siting options, and interconnection costs
- Estimates of energy output
- Cost assessments and cost savings
- Economic analysis
- Risk assessment

In most cases a consultant should be hired to conduct a feasibility study. The analytical skills of a professional consultant are important to accurately assess the viability of the project.

The project manager should look for a consultant with specific experience in preparing feasibility studies for wind projects. The Department of Natural Resources maintains a list of analysts qualified to conduct wind feasibility studies. The list is posted as the 2002 Wind Analysis Guidelines under energy publications on the DNR Web site at: www.iowadnr.com/energy/. If a public facility is using the Iowa Energy Bank Program for financing (see page 10), it is required to use an analyst qualified by the program. The DNR Web site also provides Wind Feasibility Analysis Guidelines for use with the Iowa Energy Bank program.



Wind Speed Data

For a full wind feasibility study, measurements should be taken in accordance with American Wind Energy Association (AWEA) standards, found on the AWEA Web site at: www.awea.org. Data should be collected as close to the intended turbine location and hub height as possible. This can be done by placing an anemometer (wind speed monitoring device) and a wind vane on an existing tower, such as a communications tower, or erecting a special meteorological tower for purposes of collecting wind data.

Ideally, wind data should be collected for at least three years at a site. If a long-term wind monitoring reference site is located nearby and can be used for correlation, a single year's data may be adequate. There can be significant annual variations in wind speed and availability, so the longer the wind monitoring period, the more accurate the predictions of potential turbine output can be.

Data collected should include:

- Hourly average wind speeds and direction
- Frequency distribution
- Monitoring height

Size, Design and Siting Options

The size of the turbine or turbines refers to their rated capacity. Wind turbines are available in rated capacities of less than 1 kilowatt (kW) to 1.5 Megawatts (MW) and higher. However, wind turbines' actual capacity and output are much lower than rated capacity, simply because the wind does not blow all of the time. The amount of electricity produced can be estimated with the following equation:

Electricity projection = Rated capacity x 8760 (number of hours in a year) x projected capacity factor

Example: $750 \text{ kW} \times 8760 \times 33\% = 2,168,100 \text{ kWh}$

Typically, in Iowa, the average monthly wind speeds are much lower in the summer and highest in the winter and spring.

An important consideration in the sizing and design is the purpose of the project. Is the wind project primarily designed to meet the needs of an individual facility or community? In that case, information about a facility or community's energy use, including periods of highest and lowest consumption, are required to determine the appropriate size of a proposed wind project.

Is the project designed to generate electricity for sale to the grid? If that is the case, other issues, such as transmission capacity and purchase contracts, must be considered.

Wind turbines do not require large amounts of land, and they are compatible with other uses such as agriculture and open spaces. Some of the considerations for siting include:

- **Topography of the land and surface obstructions.** The wind turbine should be higher than anything else around, including buildings and trees. The turbulence in the air movement caused by surrounding obstructions robs the wind of its power and causes wear and tear on the turbine.
- **Access to electric distribution or transmission lines.** Costs for building an additional line can affect the financial feasibility of a project, so proximity to distribution or transmission lines is critical.
- **Zoning and permitting.** Local zoning laws and permitting requirements may affect the siting of a project. For towers taller than 200 feet, FAA permits are required.
- **Environmental issues.** Wind turbine projects, if not properly sited, can encounter issues with noise, visual impacts, birds and other biological resources, and public health and safety. These problems can be avoided by carefully selecting a site and involving input from neighbors and local experts.

Estimates of Energy Output

With exact measurements of wind speed through meteorological readings at the selected site, the energy output of the turbine can be estimated with more precision, and high and low estimates can be provided. Being able to project energy output within a range of values, in addition to averages, is important for predicting the economic feasibility of the project.



Cost Assessments and Cost Savings

If the economics in the preliminary assessment appear to be positive, a more in-depth feasibility study will break out actual costs and expected savings.

Cost data should include the following:

- **Design and project management costs:** engineering design, construction management, project management, commissioning.
- **Interconnection costs:** equipment and engineering required to interconnect with the utility system.
- **Material costs:** turbine, tower, controls, electric system, cost of freight.
- **Installation costs:** permitting or licenses, foundation, site preparation (including excavation, grading, fences, and surveying), crane (if necessary), labor.
- **Operation and maintenance costs:** costs for annual maintenance contract, or costs for the owner to perform annual or routine maintenance and stock frequently replaced parts such as electrical components.
- **Utility Costs:** potential ongoing utility costs as part of utility agreement, such as deferred interconnection costs.
- **Cost of money for financing.**
- **Insurance.**

The following cost savings may be available:

- **Purchased power savings.** A facility erecting a wind turbine will save money on power it would normally purchase from its utility. A utility constructing a turbine may be able to reduce its purchased power from other suppliers, which may provide savings in demand charges, energy charges and transmission fees.
- **Production incentives.** Federal production tax credits may be available for privately owned projects, and the Renewable Energy Production Incentive (REPI) may be available for publicly owned wind turbines. Currently, the credit or incentive is valued at 1.75 cents/kilowatt hour.

Economic Analysis

Using the assumptions and information gathered in all of the previous steps, the economic analysis attempts to form conclusions about the economic feasibility of the project. The desired outcome would be that the project would not only break even financially but could actually produce savings or positive cash flow for the owner.

Risk Assessment

If the economic analysis is positive, the final evaluation that should be done is to assess any potential risks to the success of the project. This evaluation will evaluate risks relating to uncertainties, including:

- Changes in or around the site selected, such as changes in wind obstructions.
- Loss of incentives from utility agreements.
- Loss of or decline in production tax credits or the Renewable Energy Production Incentive (REPI).
- Changes in electric rates.

Risk assessment should be thorough, but inclusion of every possible project risk could create an impossible number of scenarios for analysis. Risk assessment should target the most likely scenarios based on current social, political, environmental and economic factors.

Utility Issues



Step 5: Pursue a Utility Agreement

Potential wind project owners or developers should contact their utilities during the early stages of the project, as the feasibility is being studied. The utility's purchase rates, interconnection requirements and costs, and net metering arrangements, as discussed below, will all have an impact on the economics of the project. Each utility will have a process through which an agreement will be negotiated.

The Public Utility Regulatory Policies Act (PURPA) requires utilities to purchase power from, or wheel power for, Qualifying Facilities (QFs) such as wind generators. PURPA also requires utilities to make such interconnections with QFs as may be necessary to accomplish purchases or sales. These requirements are included in the *Code of Federal Regulations, Chapter I – Federal Energy Regulatory Commission, Part 292*.

Generators must file information with the Federal Energy Regulatory Commission (FERC) to be considered a "Qualifying Facility." Utilities are not obligated to purchase from or interconnect with non-QF wind generators.

Guidelines for securing QF status are available on the FERC Web site at: www.access.gpo.gov/nara/cfr/waisidx_00/18cfr292_00.html. These rules also are covered in Iowa law, in the Iowa Administrative Code (IAC) 199 Chapter 15, which gives the Iowa Utilities Board some jurisdiction over interconnection issues.

Purchase rates are based on the avoided costs of each utility. Avoided costs are the utility's incremental costs for energy or capacity, which, if it were not purchasing from the wind generator, it would have to generate itself or purchase elsewhere.

Net metering is required of rate-regulated utilities in Iowa. According to IAC 199—15.11(5), these utilities must offer to operate in parallel (with a single meter monitoring only the net amount of electricity sold or purchased) with a QF, providing the QF meets all other applicable standards.

Standards for interconnection, safety and operating reliability are currently covered in IAC 199—15.10(476). The code states that QFs must meet applicable standards to be eligible for interconnection to an electric utility system. The section lists several ANSI and electrical code provisions.



QFs are obligated to pay any interconnection costs, although some utilities may offer to share some of those costs. Interconnection costs should be reimbursed to the utility at the time costs are incurred, but an agreement may be reached to spread those payments over a period of time as long as no other utility customers bear any of the costs of interconnection.

The Federal Energy Regulatory Commission (FERC) has proposed national standards for small generator interconnection agreements and procedures. The Notice of Proposed Rulemaking (NOPR) filed in April 2002 is intended to facilitate development of renewable resources and to further customer choice of technologies and fuels. Information about the FERC NOPR is available online at: www.ferc.gov/electric/electric.htm.



Step 6: Evaluate the Impacts on Utility Power Contracts and Rate Structures

For some smaller utilities, the addition of wind generation facilities to a utility system can affect utility power contracts and rate structures. For example, some utilities have all-requirements contracts through which they must purchase all of their electricity from one supplier. Other utilities may have allocations from the Western Area Power Administration for low-cost power. Purchasing wind energy from a local facility, or installing their own generator, may be contractually difficult or economically cost-prohibitive for some smaller utilities.

In some cases, displacing a large customer's load with wind energy can have a negative impact on the rest of a small utility's customer rates. For example, if a school is the utility's largest electricity user and installs a wind turbine, the utility can lose a significant percentage of its electric revenue. This means the cost of maintaining the electric system must be passed to the remaining business and residential customers.

While wind projects under these types of conditions are not impossible to develop, these issues should be considered before the project begins, or addressed in contracts between the wind generation owners and the utilities.

Financial Issues



Step 7: Apply for Financial Assistance

Several sources of financial assistance are available regionally and nationally. Some are open only to private entities, others only to public institutions. Listed below are descriptions and guidelines for these programs.

Iowa Energy Bank Program

The Iowa Energy Bank is an energy management program targeting public and non-profit facilities such as schools, hospitals, private colleges, and local governments. Qualified analysts customize energy solutions to meet the specific needs of an organization, with the assurance of high technical quality and the potential for attractive cost savings. Financing is provided through area lending institutions that create budget-neutral, affordable financial packages. More information on the Iowa Energy Bank Program is available at: www.state.ia.us/dnr/energy/programs/index.htm.

Alternate Energy Revolving Loan Program (AERLP)

The AERLP, administered by the Iowa Energy Center, is a loan program for individuals or organizations (except non-rate regulated utilities) wanting to build renewable energy production facilities in Iowa.

The AERLP provides loan funds up to 50 percent of the project's financed costs (up to \$250,000) at zero-percent interest. Matching financing must be obtained from a lender of the applicant's choice. The lender manages the entire loan and arranges for repayment to the AERLP.



The lending institutions are responsible for financially qualifying the borrower, while the Iowa Energy Center assists in technically qualifying the borrower. To be considered, borrowers must complete a technical loan application. Applications are accepted four times per year, by January 31, April 30, July 31, and October 31.

More information about the AERLP is available on the Iowa Energy Center's Web site at: www.energy.iastate.edu.

Community Development Block Grant Fund (CDBG)

The Iowa Department of Economic Development (IDED) offers the CDBG program to cities with populations of less than 50,000, and counties. Renewable energy facilities have been funded under the CDBG Community Facilities Fund. Cities and counties may apply for renewable projects on behalf of non-profit sub-recipients, but school projects will probably not be funded. The population being served must be at least 51 percent low and moderate income (LMI). Communities can document their LMI requirement through census data or by using the CDBG program's survey protocols.



The applicant must document a financial need for assistance and should be able to show the financial and other benefits to energy users. More information on the CDBG program is available on the IDED Web site at: www.state.ia.us/ided/crd/community/fac&srv.html.

Federal Renewable Electricity Production Tax Credit

Private entities subject to taxation (corporations, small businesses and individuals) that generate electricity from wind are eligible to receive a Renewable Electricity Production Tax Credit (PTC) for electricity sold to unrelated parties during the first 10 years after the facility is placed into service. The PTC is adjusted annually for inflation. The size of the turbine or turbines refers to their rated capacity. In calendar year 2002 the credit was 1.8 cents per kWh. For information on and to claim the PTC, see IRS *Form 8835: Renewable Electricity Production Credit*. Additionally, *Form 3800: General Business Credit* must be filed.

Federal Renewable Energy Production Incentive (REPI)

Non-taxpaying entities can apply for an incentive payment from the U.S. Department of Energy for electricity produced and sold by new qualifying renewable energy generation facilities. Eligible electric production facilities are those owned by state and local government entities (such as municipal utilities) and non-profit electric cooperatives that started operations between October 1, 1993 and September 30, 2003.

Qualifying facilities are eligible for annual incentive payments (currently at 1.7 cents/kWh) for the first 10-year period of their operation, subject to the availability of annual appropriations in each federal fiscal year of operation. Criteria for qualifying facilities and application procedures are contained in the IRS rules for this program. Qualifying facilities must use solar, wind, geothermal (with certain restrictions as contained in the rules), or biomass (except for municipal solid waste combustion) generation technologies. More information on REPI is available at: www.eere.energy.gov/power/rep/html.



Green Tags and Green Pricing Programs

Electricity generated from a wind turbine has two values: 1) the commodity electricity, which can be used or sold; and 2) the environmental attribute of the renewable generation. The value of this environmental attribute can be expressed in a green tag, or renewable energy certificate, which can be sold or traded.

Wind generators may be able to sell green tags from their facilities to utilities, businesses, or others. This may provide additional value to new wind projects.

Accelerated Depreciation

Under the Modified Accelerated Cost Recovery System (MACRS), the system of federal tax depreciation, wind property is given special consideration. Typically, non-renewable power supply investments are depreciated over 15-20 years, but wind property is provided a depreciation life of five years. This quicker depreciation schedule provides benefits to investors.



Step 8: Apply for Local and State Tax Exemptions

Incentives for wind generation have been enacted affecting local property tax payments, state sales tax, and utility replacement taxes.

Local Option Special Assessment of Wind Energy Devices

Iowa Code 427B.26 allows city councils or county boards of supervisors to enact ordinances for the special valuation of “wind energy conservation property” for up to 20 years. This allows for a waiver of or reduction in property taxes for the entire wind plant, including wind turbine, tower and electrical equipment, pad mount transformers, power lines, and substations. It does not apply to the land on which the wind equipment is located. The statute also allows the council or board to discontinue the special valuation through repeal of the ordinance. The rules for the special valuation are as follows:

- By Feb. 1 of the assessment year in which the wind energy conversion property is first assessed, the taxpayer must file a declaration of intent to have the property assessed at the value derived in the tax guidelines.
- For the first assessment year, the assessor will assess the property at zero percent of the net acquisition cost.
- For the second through sixth years, the property will be assessed at a percent of the net acquisition cost, increasing by 5 percent each year.
- For the seventh and succeeding assessment years, the property will be assessed at 30 percent of the net acquisition cost.
- Unless the ordinance is repealed, this valuation would be continued until the end of the nineteenth assessment year following the assessment year in which the property was first assessed.
- If the ordinance has not been adopted or the taxpayer fails to file for special valuation, the assessable and taxable value of property shall not increase with new construction of wind or solar energy systems for five full years (Iowa Code 428.24 -428.29 and 441.21 (8)).

Sales Tax Exemption for Wind Energy Conversion Property

As above, wind energy conversion property is the actual wind turbine and associated electrical equipment. Iowa Code 422.45 exempts from sales tax the gross receipts from the sale of wind energy conversion property to be used as an electric power source and the sale of the materials used to manufacture, install or construct wind energy conversion property used or to be used as an electric power source.

The sales tax exemption works in two ways. First, the turbine buyer can obtain an Iowa Sales Tax Exemption Certificate (Form 31-014). This form can be found on the Iowa Department of Revenue and Finance’s Web site at: www.state.ia.us/tax/forms/31014.pdf. The turbine seller should not charge

sales tax if he or she receives this form. The second option is to pay the sales tax and then file for a refund. This can be accomplished through an IA 843 claim at: www.state.ia.us/tax/forms/22009.pdf

Replacement Tax Exemption for Wind Energy Conversion Property

As above, wind energy conversion property includes the actual wind turbine and associated electrical equipment. The electricity generated by wind facilities is exempt, by Iowa Code 437A.6, from the replacement tax of six hundredths of a cent imposed on electricity generated in Iowa.

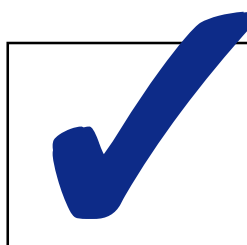
Permitting Issues



Step 9: Contact Local Permitting Officials

In Iowa, zoning and permitting is handled on a county and/or city level. Each county or city may have different guidelines and application procedures to follow. If the project is located outside city limits, the county board of supervisors should be contacted. If it is within city limits, it will be necessary to contact the city planning office for additional information on zoning ordinances.

Most small turbine projects take up very little land space. But if more than one acre is used for construction, a state stormwater construction permit may be required. Contact the wastewater section of the DNR for more information at (515) 287-8877.



Step 10: File for FAA Permit If Needed

If any temporary or permanent structures in the project exceed 200 feet (61 meters) above ground level, the project owner must notify the Federal Aviation Administration (FAA). A preconstruction notice (Form 7460-1) must be submitted at least 30 days before the proposed construction begins. The FAA will acknowledge receipt of the form and begin an airspace evaluation.

Based on the evaluation, the FAA will issue requirements for lighting and/or marking along with FAA Form 7460-2. Part 1 of that form must be submitted at least 48 hours prior to starting the actual construction, and Part 2 must be returned to FAA no later than five days after the structure has reached its greatest height.

FAA forms and instructions are available at: www1.faa.gov/ats/ata/ata400/oeaaa.html.

Installation



Step 11: Solicit Bids for Purchase and Installation

Project owners should request bids for purchasing and installing equipment from wind turbine manufacturers and developers. For publicly owned and non-profit facilities, the applicable bidding and procurement rules, such as Request for Proposal guidelines, should be followed.

The bid request should include some or all of the following elements:

- Background information of company
- Key project participants and contractors
- Project timeline/schedule
- Technical specifications
- Bid format
- Proposal requirements
- Project summary/description
- Equipment specifications
- Experience and qualifications of project team
- Energy projections
- Project budget with breakdown of projected capital costs
- Financial projections
- Project schedule
- Permits
- Interconnection/transmission construction requirements
- Construction arrangements
- Testing
- Operation and maintenance plan (optional)
- Project bid broken down by delivered price and value of energy
- Decommissioning and site reclamation provisions
- Amount of fossil fuels displaced and other environmental benefits
- References

Installation costs, in addition to the cost of turbine and electrical equipment, will include foundations, road construction, a transformer, telephone connection and cabling costs. Installation costs can vary according to soil conditions, distances to existing roads, the cost of getting a crane to the site, distances to power lines, and transportation costs for the turbine equipment.

Operation



Step 12: Formulate a Plan for Operation and Maintenance

Wind turbines have a design lifetime of 25 years or more. Maintenance costs are typically low while the turbines are new, but can increase somewhat with age. Estimates for the yearly operation and maintenance costs for the newest turbines are 1.5 to 2 percent of the original turbine investment. Maintenance can also be estimated as a fixed amount per kilowatt-hour, usually about 1-2 cents/kWh.

Most maintenance costs are for routine service on the turbines. Routine service includes regular inspections and periodic maintenance based on recommendations provided by the manufacturer. Some of the tasks carried out during periodic maintenance might include checking shaft alignment, checking brake adjustment and wear, greasing bearings, checking pitch calibration, tightening bolts, checking electrical and electronic equipment and connections, and others.



Breakdown maintenance is also needed when the turbines trip off automatically or when parts need to be repaired or replaced.

Wind turbine maintenance and repair is a specialized field. Manufacturers may require a trained, certified windsmith to conduct routine work. Wind project owners may choose to contract with a wind maintenance firm for these services. Because these firms work throughout the Midwest, they may provide expertise at a lower cost than training staff at individual wind turbine facilities.

Most wind turbine manufacturers provide a one-year warranty, but extended warranties are available.

The Next Step



The Wind Energy Checklist is a starting point for Iowans interested in pursuing a wind turbine project. It provides step-by-step guidance on how to get a project started and implemented. From here, many resources are available to help answer questions and provide expertise. The following pages provide a list of those resources, along with a series of worksheets for calculating and tracking important data that contribute to making an informed decision.



Undertaking the installation of a wind turbine can be an exciting prospect. It is important to weigh all issues, including budget, utility, permitting and operational concerns. For those who decide wind energy is the right choice, the advantages of clean, renewable power will provide a sound return for their investment.



Resources and References

American Wind Energy Association

- Information on renewable energy policy and economics, wind industry and wind technologies. Available online at: www.awea.org.

Code of Iowa

- Wind energy equipment exemption — Iowa Code 2001 Supplement: Section 422.45(48).
- Special valuation of wind energy conversion property – Iowa Code 2001 Supplement: Section 427B.26.
- Replacement tax imposed on electric generation – Iowa Code 2001 Supplement: Section 437A.6. Available online at: www.legis.state.ia.us/cgi-bin/IACODE/Code2001SUPPLEMENT.pl.

Danish Wind Energy Association

- Installation Costs for Wind Turbines.
- Operation and Maintenance Costs for Wind Turbines. Available online at: www.windpower.org.

Dodge, Darrell M.

- "Illustrated History of Wind Power Development." Available online at: <http://telosnet.com/wind/index.html>.

Federal Aviation Administration

- Advisory Circular 70/7460-1K, Obstruction Marking and Lighting. Available online at: www1.faa.gov/ats/ata/ata400/oeaaa.html.

Federal Energy Regulatory Commission

- Chapter 1 – Federal Energy Regulatory Commission, Part 292 – Regulations Under Sections 201 and 210 of the Public Utility Regulatory Policies Act of 1978 with Regard to Small Power Production and Cogeneration. Available online at: www.access.gpo.gov/nara/cfr/waisidx_00/18cfr292_00.html.

Green-E, Center for Resource Solutions

- Information on certification and trading of renewable energy certificates. Online at: www.green-e.org or from Center for Resource Solutions, Presidio Building 49, P.O. Box 29512, San Francisco, CA 94129; phone (415) 561-2100, fax (415) 561-2105.

Guey-Lee, Louise

- "Wind Energy Developments: Incentives in Selected Countries." Available online at: www.eia.doe.gov/cneaf/solar.renewables/rea_issues/html/windart.html.

Interstate Renewable Energy Council

- Services and products targeted at education, coordination, and procurement for state and local government officials. Includes the DSIRE database of state incentives. Available online at: www.irecusa.org or from Interstate Renewable Energy Council, POB 1156, Latham, New York 12110-1156; phone and fax (518) 458-6059; e-mail: info@irecusa.org.

Iowa Administrative Code

- Utilities [199] Chapter 15: Cogeneration and Small Power Production. Available by selecting Iowa Administrative Code online at: www.legis.state.ia.us/.

Iowa Department of Economic Development

- Community Facilities and Services Program. Information available online at: www.state.ia.us/ided/crd/community/fac&srv.html or by calling (515) 242-4836.

Iowa Department of Natural Resources

- "2002 Wind Feasibility Analysis Guidelines."
- "Small Wind Electric Systems: An Iowa Consumer's Guide."
Available online at: www.iowadnr.com/energy/programs/wind/index.htm or from DNR Energy and Waste Management Bureau, Wallace State Office Building, 502 E. 9th Street, Des Moines, IA 50319-0034; phone (515) 281-5918, fax (515) 281-8895.

Iowa Energy Center

- "Financial Incentives for Developing Renewable Facilities in Iowa."
- "Wind Energy Manual."
- Wind Turbine Output Calculator. Available online at: www.energy.iastate.edu or from the Iowa Energy Center, 2521 Elwood Drive, Suite 124, Ames, IA 50010; phone (515) 294-8819, fax (515) 294-9912; e-mail: iec@energy.iastate.edu.

Iowa Renewable Energy Association

- Information on advocacy, workshops, and renewable technologies. Available online at: www.irenew.org.

National Renewable Energy Laboratory

- Information on the Department of Energy's renewable energy research and development programs. Available online at: www.nrel.gov.

National Wind Coordinating Committee

- "Permitting of Wind Energy Facilities: A Handbook." August 2002. Available online at www.nationalwind.org, or from the National Wind Coordinating Committee Outreach Coordinator c/o RESOLVE, 1255 23rd Street NW, Suite 275, Washington, DC 20037; phone (888) 764-WIND, (202) 944-2300; fax (202) 338-1264; e-mail: nwcc@resolv.org.

Righter, Robert

- Wind Energy in America: A History. 1996: University of Oklahoma Press.

Sagrillo, Mick

- "Site Analysis for Wind Generators." Home Power #41, June/July 1994. Also available at: www.eere.energy.gov.html.
- "Advice from an Expert on Small Wind Systems." Available online at: www.awea.org/faq/sagrillo/index.html.

U.S. Department of Energy

- Renewable Energy Production Incentive (REPI). Available online at: www.eren.doe.gov/power/rep.html or from National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80401; phone: (303) 275-4905, fax: (303) 275-4753; e-mail: keith_bennett@nrel.gov.
- Financial Incentives for Business Investments in Renewable Energy. Available online at: www.eere.energy.gov/consumerinfo.htm.
- Wind Powering America Program. Information and resources, including anemometer loan program. Online at: www.eere.energy.gov/windpoweringamerica.

Utility Wind Interest Group

- Information on utility applications for wind energy. Online at: www.uwig.org.

Wincharger.com

- A Web site dedicated to the history and preservation of the Wincharger electric systems manufactured in Iowa in the 1920s and 1930s, available online at: www.wincharger.com.

Windustry

- Wind Basics Fact Sheets: "Introduction to Wind Energy," "Why Wind Energy," "Know Your Wind," "Know Your Land," "Wind Energy Economics," "Choosing a Business Structure."
- Wind Project Calculator. Available online at: www.windustry.com or from Windustry, 2105 First Avenue South, Minneapolis, MN 55404; phone (800) 946-3640, fax (612) 870-4846; e-mail: info@windustry.org.

Energy Use Data Worksheet

<i>Month</i>	<i>Electricity Consumption per Month (kWh)</i>	<i>Average Daily Consumption per Month (kWh)</i>
<i>January</i>		
<i>February</i>		
<i>March</i>		
<i>April</i>		
<i>May</i>		
<i>June</i>		
<i>July</i>		
<i>August</i>		
<i>September</i>		
<i>October</i>		
<i>November</i>		
<i>December</i>		
<i>Annual kWh Total</i>	<i>kWh</i>	<i>kWh</i>
<i>Highest Electricity Consumption</i>	<i>Month: _____ kWh</i>	
<i>Lowest Electricity Consumption</i>	<i>Month: _____ kWh</i>	

Notes:

Life Cycle Cost Analysis - Do Nothing Option

Compare results to Life Cycle Cost Analysis - Wind Option on the next page. See page 24 of this book for information on further assistance.

Current kWh/year consumed: _____ kWh (kWh)

Current Price of Electricity: \$ _____ /kWh (\$/kWh)

Study Period: _____ years

LCC Calculation

$$\text{LCC} = [(\text{kWh}) \times (\$/\text{kWh})] \times (\text{UPV})^*_{\text{study period}}$$

LCC = \$ _____

Notes:

SPV - Single Present Value Factor (nonfuel items)

UPV - Uniform Present Value Factor (nonfuel items)

UPV* - Modified Uniform Present Value Factor (adjusted for fuel price escalation)

Use FEMP indices only.

Life Cycle Cost Analysis - Wind Power

See page 23 of this book for information on further assistance.

Estimated Purchase and Installation Costs:	\$ _____	= (P&I)
Estimated Salvage/Residual Value:	\$ _____	= (SAL)
Additional Energy Produced and Sold to Utility:	_____ kWh	= (kWh) _{produced}
Additional Energy Purchased from Utility:	_____ kWh	= (kWh) _{purchased}
Current Price of Electricity:	\$ _____	/kWh = (\$/kWh)
Annual Maintenance Costs:	\$ _____	= (AM)
Repair and Part Replacement Stock:	\$ _____	every _____ years = (R&R)
Useful Life:	_____	years
Study Period:	_____	years

Life Cycle Cost (LCC) Calculation

For additional energy produced and sold to the utility:

$$\text{LCC} = (P\&I) - ((SAL) \times (SPV)_{\text{study period}}) - ((kWh)_{\text{produced}} \times (\$/kWh) \times (UPV)^*_{\text{study period}}) + ((AM) \times (UPV)_{\text{study}}) + ((R\&R) \times (SPV)_{R\&R \text{ year}})$$

$$\text{LCC} = \$ \underline{\hspace{2cm}}$$

For additional energy purchased from utility:

$$\text{LCC} = (P\&I) - ((SAL) \times (SPV)_{\text{study period}}) + ((kWh)_{\text{purchased}} \times (\$/kWh) \times (UPV)^*_{\text{study period}}) + ((AM) \times (UPV)_{\text{study}}) + ((R\&R) \times (SPV)_{R\&R \text{ year}})$$

$$\text{LCC} = \$ \underline{\hspace{2cm}}$$

Notes (see the Web site listed on page 23 to obtain values for the following numbers):

SPV - Single Present Value Factor (nonfuel items)

UPV - Uniform Present Value Factor (nonfuel items)

UPV* - Modified Uniform Present Value Factor (adjusted for fuel price escalation)

For additional energy produced and sold to the utility, use the buy back rate (\$/kWh) agreed upon with the utility. For energy purchased, use the current purchasing rate (\$/kWh).

Life Cycle Costing

An explanation of Life Cycle Cost Analysis (LCCA) can be found in the Life Cycle Costing Manual for the Federal Energy Management Program, NIST Handbook 135, 1995 edition. Current indices can be found in the Annual Supplement to NIST Handbook 135.

Rates are updated each April. The Annual Supplement to NIST Handbook 135 document (which include current rates and the current version of the BLCC computer program) may be downloaded from:

<http://www.eren.doe.gov/femp/techassist/softwaretools/softwaretools.html>

FEMP rates are to be used (do not use Office of Management and Budget (OMB) rates). Analysts who do not have internet access to the FEMP rates may contact the Energy & Waste Management Bureau at (515) 281-6559.



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